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CLAIMS

1        1. A computer-aided method for balancing the spectral  
2 response characteristics of vertically and transversely-  
3 polarized seismic receiver components relative to an in-line  
4 polarized seismic receiver component of a three-component  
5 seismic transducer employed in a multi-dimensional seismic  
6 survey, comprising:

7              defining limits for near-offset source-receiver  
8 trajectory vectors in range and azimuth;

9              assembling in a computer matrix a plurality of seismic  
10 wavefields emanating from near-offset source locations in a  
11 common-receiver in-line gather, a common-receiver cross-line  
12 gather and a common-receiver vertical gather;

13              defining a preferred reflection-time window length;

14              normalizing said common receiver gathers for spherical  
15 divergence;

16              transforming said seismic wavefields from the time  
17 domain to the frequency domain;

18              generating first deconvolution operators for the cross-  
19 line component;

20              applying said first operators to the cross-line and the  
21 vertical receiver gathers to form a corrected cross-line  
22 component;

23              generating second deconvolution operators for  
24 minimizing vertical component energy;

25              applying said second deconvolution operators to the  
26 cross-line and vertical receiver gathers to form a corrected  
27 vertical component.

1        2. A computer-aided method for balancing the spectral  
2 response characteristics time-scale traces representative of  
3 vertically and transversely-polarized seismic receiver

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4 components relative to an in-line polarized seismic receiver  
5 component of a three-component seismic transducer employed  
6 in a three-dimensional seismic survey, comprising:

7 a) selecting an initial receiver station and assembling  
8 in a computer matrix a plurality of seismic wavefields  
9 emanating from near-offset source locations in a common-  
10 receiver in-line gather, a common-receiver cross-line gather  
11 and a common-receiver vertical gather;

12 b) defining limits for near-offset source-receiver  
13 vectors in range and azimuth relative to the initial  
14 receiver station;

15 c) defining a preferred reflection-time window length;

16 d) normalizing said common receiver gathers for  
17 spherical divergence;

18 e) transforming said seismic wavefields from the time  
19 domain to the frequency domain;

20 f) calculating the terms for the cross-line component  
21 for each frequency from

$$\begin{pmatrix} \Sigma_i \cos^2(\theta_i) \bar{y}_i \bar{y}_i & \Sigma_i \cos^2(\theta_i) \bar{z}_i \bar{y}_i \\ \Sigma_i \cos^2(\theta_i) \bar{y}_i \bar{z}_i & \Sigma_i \cos^2(\theta_i) \bar{z}_i \bar{z}_i \end{pmatrix} \begin{pmatrix} c(\omega) \\ w(\omega) \end{pmatrix} = \begin{pmatrix} \Sigma_i \sin(\theta_i) \cos(\theta_i) \bar{x}_i \bar{y}_i \\ \Sigma_i \sin(\theta_i) \cos(\theta_i) \bar{x}_i \bar{z}_i \end{pmatrix};$$

22 g) solving for the cross-line coupling coefficients,  
23  $c(\omega)$  and  $w(\omega)$  for each frequency;

24 h) calculating terms for each frequency for the  
25 vertical component from

26

$$v(\omega) \sum_i \bar{z}_i \bar{z}_i = w(\omega) \sum_i \bar{y}_i \bar{z}_i;$$

27

28 i) solving for the vertical coupling coefficients,  $v(\omega)$   
29 for each frequency;

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30           j) correcting the cross-line component time-scale trace  
31 response characteristics,  $y(\omega)$ , using  
32            $y(\omega) = c(\omega)y'(\omega) + w(\omega)z'(\omega);$   
33           k) correcting the vertical component time-scale trace  
34 response characteristics,  $z(\omega)$ , using  
35            $z(\omega) = -w(\omega)y'(\omega) + v(\omega)z'(\omega);$  and  
36           l) displaying, with the aid of a computer graphics  
37 program, the corrected cross-line and vertical time scale  
38 trace components.

1           3. The method as defined by claim 2, comprising:  
2           repeating steps a) through l) for all subsequent  
3 receiver stations.